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CENTRAL INTELLIGENCE AGENCY

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(FOR KEY SEE REVERSE)

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Comments

1.

2. On page 1, paragraph 1, reference is made to the Ministry of Shipbuilding; the correct designation is the Ministry of Shipbuilding Industry.

3. On page 3, paragraph 6c, reference is made to the "Ministry". Undoubtedly the Ministry of Shipbuilding Industry is meant since Institute 49 is subordinate to that ministry.

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THIS IS UNEVALUATED INFORMATION

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COMPUTER DEVELOPMENT AT NII 49 PRIOR TO THE GERMAN SPECIALISTS' ARRIVAL

1. The Kreiselgeraete group began working at Institute 49, Leningrad on 1 December 1946. the Soviet engineers the field of antiaircraft and special computers was entirely new to them at that time, and probably also to the Institute itself. Data brought from Germany after the war, and knowledge of German reconstruction activity in Berlin after 1945 probably gave the Institute the first insight into this field of activity. It was perhaps the initiative of the Ministry of Shipbuilding which had resulted in the establishment of a development section especially assigned to these computers. The engineers of this section were primarily from conventional control and amplifier departments. these departments had been in the Institute for some time

50X1-HUM

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SECURITY INFORMATION

50X1

SOVIET METHODS AND TECHNIQUES OF COMPUTER DEVELOPMENT

2. With the resumption of task of reconstructing the Rheintochter, 50X1-HUM
Schmetterling and Wasserfall computers, discovered the simultaneous 50X1-HUM
genesis of a parallel activity in the Soviet laboratories. Through 50X1-HUM
questions posed by the Soviet engineers also learned that t
method of attacking such development problems on their part was diametrically opposed to the German approach. After a thorough study of the theoretical aspects of a solution based on the technical requirements, the primary consideration of German development was the experimental work. Improvised mock-ups gave an indication of the realization of theoretical assumptions without taking into account an exact specification of the electrical and mechanical parts, and without any special attention devoted to accuracy requirements. In this respect some attention was paid to the amplifier circuits, which were usually based on past experience. Only after presentation of marked results and amplification of the practicability of the recommended method of solution was there a detailed design completed and an experimental model made and examined. This model served for the preliminary accuracy measurements; the possibilities of improvement were defined after the exact limiting of the cause of error was made.

3. The Soviet engineers, on the other hand, placed chief emphasis on the theoretical delineation of all procedures, detail parts, and the entire device. They themselves always demanded that the Germans set up a mathematical formula for everything which insured the construction of a perfectly functioning and completely accurate device. On the whole, they had no practical imagination and were completely lacking in the "know-how" and experimental techniques required for such development problems. They also had very little conception and feeling for the technically possible accuracies of such devices. For example it was very difficult to convince the Soviets of the fallacy of their requirement that the Wasserfall computer have an accuracy of $\pm$ 1 mil (360° = 6400 mils) in the output values. They requested this even though the errors of the individual parts such as the transmission system, coordinate resolvers, potentiometers, etc., were already greater than the required total error and disregarded the difficult differential equations (initial trajectory equation) to be solved by the computer and the parallax computation which could only be made by means of a series of 50X1-HUM computations.

50X1-HUM

4. Only after Germans had shown the Soviets these individual errors (with the help of specially constructed testing and measuring instruments, such as coordinate-resolver test arrangements, potentiometer measuring sequence, and system testing), were able to convince them in part, of the impracticability of such accuracy. The Soviets then set requirements for the improvement of the c 50X1-HUM
ponent parts, but would not accept them, since did not see 50X1-HUM
how the Kreiselgeraete group could accomplish something that had taken years of special development. Only after the Soviets themselves began construction of selsyn systems, coordinate resolvers, potentiometers, etc., did they notice a resulting greater error in their components. Although they copied German equipment exactly and used German data, they had greater errors because they were working exclusively with Soviet components. The Germans noticed this because of the continual questioning. The Germans later received large numbers of Soviet components, such as coordinate resolvers, potentiometers, selsyns, etc., for testing on their especially built

50X1

test equipment. [redacted] about 95 per cent of the components were neither suitable nor usable for computers. Those components which passed the test were probably then used for Soviet computers. In order not to give the Germans an insight into their production, however, they later borrowed German measuring equipment as well as exact directions for their use. 50X1-HUM

DEVELOPMENT PROBLEMS

5. Another difficulty in development was the wide tolerances of all standard parts, such as tubes, resistors, condensers, etc. The vacuum tubes varied greatly in their characteristics, were dependent on the temperature, and aged quite rapidly. The highest quality resistors and condensers were those of ± two per cent, but these could only be used upon the special permission of the chief engineer. The Germans were permitted to use freely only those ≥ ± five per cent. These tolerances were not reliable, however, and these components also varied greatly with temperature. The necessity for individually testing each component was thus a time-consuming requirement. For purposes requiring a high degree of accuracy, such as initial trajectory computer, tau-filter, etc., the Germans had to select components from a great number of parts by means of testing or by taking them apart and reassembling them with more accurate components.

Component Parts Shortage

6. In general, the work of development was complicated further by the following:

a. The entire accessories industry, especially for electrical parts, seemed to be in its primary stages, as the stress in industrial production was on heavy industry.

b. The electrical component parts industry seemed to rely heavily on German experience, German data andpartly on German specialists. The Soviet components available to the Germans at first were almost always much larger in their outside dimensions and much less accurate. This was reflected in: wire resistors with high temperature coefficients, no electrolytic condensers, no dry rectifiers, very few vacuum tube types, no coordinate resolvers, no computer potentiometers, very few selsyns, etc.

c. Procurement of supplies was always very difficult, as the prevailing bureaucratic system required that the Institute plan and requisition a year's supply of electrical components through the Ministry. The requisition detail was then given to the plants concerned, which also had to include them in their plans. Any kind of component procurement outside of this method was practically impossible.

d. As the procedure outlined in c. above required that requisitioning of certain parts be apportioned to a definite development project, it was practically impossible to store parts for later projects.

e. A continuing changing of specifications for electrical components was also noticeable. [redacted] 50X1-HUM [redacted] the specifications of electrical data, the dimensions, and the accuracies of, e.g., condensers, resistors, normal potentiometers, rectifiers, vacuum tubes, transformers, etc., were changed. This required time-consuming redesign and in some cases new development.

f. There was an obvious lack of equipment at Institute 49, especially during the first few years. One of [redacted] first 50X1-HUM tasks was to build several two-beam (?) oscilloscopes for the Soviet laboratories. Especially lacking, or in scarce supply, were frequency meters (wavemeters), wattmeters, multiple instruments (?), resistance-, capacitance- and inductance- measuring bridges, frequency generators, oscilloscopes, sensitive tubes voltmeters, tube testing equipment, etc. Standard items such as current and voltage measuring equipment, etc., that were available at first were rather old heating-wire instruments and some with a low degree of accuracy. This lack became especially noticeable when the limited equipment which had been brought to the USSR was taken to the firing range to test the Wasserfall computer. The Germans' work during that time, without the use of these oscilloscopes, multiple instruments, etc., was greatly handicapped. In later years there was an improvement in this respect because of delivery from the satellite countries, including multiple instruments from the Siemens Company in the 50X1-HUM Soviet Zone of Germany [redacted] measuring transmitters and measuring bridges from Radio Company (Funkwerk) Berlin-Koepenick, etc., as well as indigenous production of tube voltmeters, etc.

Soviet Engineers of Inferior Caliber

7. The Soviet approach to development was primarily from the theoretical aspect. The Soviets wanted to have exact mathematical formulas for all regulating amplifiers (Regelverstaerker) by which every resistor, condenser, tube, transformer, and rectifier could be dimensioned for the desired regulating procedure (Regelvorgang). This requirement was not accepted by the Germans, since even theoretically there are insoluble differential equations of a high order in which many factors enter, such as back lash, friction, stray effects, transfer resistances, surface creeping current, etc., and these cannot be formulated. The Germans examined theoretical questions regarding amplifier arrangements and especially devoted some time to stability considerations. [redacted] never devoted too 50X1-HUM much time to this point, however, and regarded it as being rather useless. The Soviets wanted formulas and specifications from which they could build amplifiers and servo-mechanized controls dimensionally and directly. They also required from the Germans exact theoretical investigations of calculation relations, especially the initial trajectory equation. The Germans also completed simpler, obvious calculation data and dimensioning of devices, such as rectifier arrangements, selsyn relays, etc.

50X1

8. The impression that the Soviet development engineers were lacking in talent was substantiated by the continuing questions they asked. The Germans also had to deliver the testing set-ups which they had constructed primarily for their own work to the Soviet laboratories. The Germans often had to turn these set-ups over to the Soviet laboratories during development work, and they were later returned. Furthermore, in the beginning almost all the Soviet engineers, even the most qualified, would ask questions pertaining to their own laboratory work. Later the questions were asked by subordinates, but it was obvious that they were not the individuals who actually wanted to know the answer: those people remained in the background. 50X1-HUM it was actually forbidden to ask direct questions. It is difficult to say if this was for reasons of secrecy, or if it was desired to teach the Soviet engineers how to be independent. Questions were still asked, however, obviously without the knowledge of the 50X1-HUM Soviet department heads.

50X1-HUM

9. Soviets had built a computer for the Wasserfall simultaneously with the German computer, and both of them were tested at the firing range. This was substantiated when, at the same time that Messrs. KLARITZKIY and HYDROW (KHITROV?) were at the firing range to test computer, the leading engine 50X1-HUM of the Soviet computer laboratory were absent from Leningrad 50X1-HUM to test their computer. The Soviets also constructed computers for Schmetterling and Rheintochter. Further details regarding the development or testing of these computers are not known

10. Soviet engineers had learned quite a bit regarding computer 50X1-HUM development, and on the basis of this experience, they are in a position to work on their own computer developments. This impression seemed to be strengthened by the fact that there were almost no questions put during the last one and one- 50X1-HUM half years in the USSR.

FUTURE TRENDS OF SOVIET COMPUTER DEVELOPMENT

50X1-HUM

11. 50X1-HUM Soviet computers will follow the principle of servo-mechanisms, and the tendency will be in the direction of greater accuracy. Accuracy was generally regarded as the most important factor, without any regard given to the technical requirements. Also noticeable was a strong tendency toward fully automatic operation. Along 50X1-HUM this there was a great increase in control systems.

12. purely electronic computer development. As the Soviets had access to all American, English and German publications in this field, however, they were pursuing this method. However not believe that this work was being done at NII 49.

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50X1-HUM

13. The problem of solving calculations by purely electronic means given to Dr. WOLFF (after he had completed his work in the high frequency field) was [redacted] merely a "make-work" task within the group. He was given the problem of multiplying electric magnitudes by purely electronic means. Dr. WOLFF attacked this problem by borrowing directly from American publications available at Institute 49. None of the responsible men at the Institute showed any interest in the results of his work and there were no further questions put to him. There was no experimental work carried out, i.e., Dr. WOLFF did all the work on paper only. [redacted] this is a further indication that the Institute had no great interest in this field. It was probably noticed that the requisite accuracies for the German computers and the required solving of complicated equations by electronic means would have required a much greater effort. 50X1-HUM 50X1-HUM 50X1-HUM

14. [redacted] the releasing of [redacted] group by Institute 49 is evidence that NII 49 was convinced that it would be capable of conducting its own computer development. MUMMERT, who remained in the USSR, was primarily an organization and design man, and is surely not in a position to carry out new development, a fact which [redacted] the Soviets know. The reason for his detention is [redacted] that there might be some questions about development work. For reasons of security the Soviets might want a man who has general knowledge of the former German activity. 50X1-HUM 50X1-HUM 50X1-HUM

[redacted] Comments: It is believed that careful attention should be given to this estimate [redacted] 50X1-HUM